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Introduction

A considerable amount of information has become available in the Northeast and in other parts of the United States on the composition and digestibility of different forages grown under varying levels of nitrogen fertilization and harvested at defined stages of maturity. This has been due mainly to the efforts of contributors in the experiment stations participating in regional research projects throughout the country, especially in the forage growing regions. Some information on acceptability of forages by ruminants has also been published since the early fifties when Crampton (7) proposed that forages should be evaluated on the basis of their nutritive value index.

Despite this large volume of information on digestibility, and some recent results on acceptability of forages, little has been published on the utilization of the digested components of these forages for maintenance or production. Most of such published information comes from European countries, Japan, and recently from the U.S.D.A. Energy Laboratory at Beltsville, Maryland (2, 8, 9).

The New Hampshire Agricultural Experiment Station has been actively engaged (3, 4, 5, 6, 10, 11) in energy metabolism research for several years and, by the use of indirect calorimeters, has been conducting complete energy balance studies with ruminants, determining the nutritive value of different forage species grown in the Northeast.

This bulletin reports the results of a two-year study of the nutritive value of redtop hay grown with 100 pounds of nitrogen per acre and cut at three stages of maturity. The nutritive value of these hays, determined by using both cattle and sheep, is presented on the basis of several methods of evaluation — total digestible nutrients, digestible protein, digestible energy, metabolizable energy, and net energy.

Experimental Rations and Animals

Nine animals were used to determine the nutritive value of the hays over the two-year period. They were a pair of identical twin Guernsey steers, a pair of twin Jersey steers, two Holstein steers, and three adult wethers. Four steers were used each year in a balanced experimental design. The identical twin Guernsey steers were used in both the first and second year of the experiment. The sheep were used for the determination of the nutritive values of the first year hays, and the values so obtained were compared with corresponding values from cattle. The relative acceptability of the hays was determined using the same adult wethers.

The redtop hays were grown with 100 pounds of nitrogen fertilization per acre. They were harvested at two different stages of maturity the first year, and three stages of maturity during the second year of the experiment. The dates of first cutting were June 15 and June 30, and the aftermath was cut July 30. During the first year there was no aftermath cutting because of a severe drought. All hays were heat-dried for uniformity. They were chopped and thoroughly mixed before being transported into the laboratory in large burlap bags. The hays were fed to the animals twice a day at which time an aliquot sample was taken to composite for chemical analysis. The methods followed in this experiment were those used in previous research reported from this laboratory (1, 6, 12).

Results and Discussion

The effect of cutting date on nutrient composition is shown in Table 1 and the nutrient digestibility and nutritive value data are presented in Table 2.

Table 1
Effect of cutting date on dry matter composition of redtop hay.

	June 15 cutting		June 30 cutting		July 30 Aftermath
	1963–64	1964–65	1963–64	1964–65	1964–65
			%		
Ash	6.38	8.08	5.67	7.55	10.27
Crude protein	11.04	12.33	7.10	9.39	17.98
Ether extract	2.64	3.39	2.29	3.51	5.19
Crude fiber	32.43	28.12	34.37	30.21	26.58
N. F. E.	47.51	48.16	50.42	49.53	39.71

Composition and yield

There were slight year differences in the proximate nutrients of the hays. One of the reasons for this difference could have been the severe drought experienced during the latter part of the 1963 growing season. The 1963 hay appeared stemmy and the plants were stunted. This observation was supported by the higher fiber and lower protein content compared to that of corresponding hays in 1964. Mean first-cutting yield in 1963 was about 3.9 T/a and in 1964, 2.3 T/a. The 1964 aftermath yielded only 0.6 T/a. Part of the year difference in first-cutting mean yields may be explained by the fact that different plots were used in the two years.

Table 2
Effect of cutting date on digestibility of ingredients and nutritive value of redtop hay

	Cattle					Sheep	
	June 15 cutting		June 30 cutting		July 30 Aftermath	1963–64	
	1963–64	1964–65	1963–64	1964–65	1964–65	June 15	June 30
Digestibility				%			
Dry matter	66.38	70.01	63.30	63.27	72.01	65.91	63.76
Energy	63.98	65.92	58.54	58.49	66.99	64.49	59.84
Protein	66.56	69.69	58.20	60.90	75.09	68.01	58.50
Fat	52.80	46.08	52.62	35.07	51.47	51.38	48.65
Fiber	73.90	72.34	67.39	67.64	77.02	70.70	68.19
N. F. E.	64.86	71.72	64.50	63.15	71.68	64.76	63.73
Nutritive value							
TDN (lb./100 lb.)	65.46	67.47	62.20	57.89	69.09	64.06	62.30
Dig. prot. (lb./100 lb.)	7.54	8.55	3.66	5.74	14.25	7.20	4.21
Dig. energy (kcal/g)	2.825	2.879	2.600	2.588	2.850	2.857	2.642
Metab. energy (kcal/g)	2.382	2.456	2.158	2.224	2.329	2.559	2.261
Net energy (kcal/g)	1.620	1.666	1.379	1.301	1.635	1.702	1.404

Digestibility

The digestibility of the dry matter, energy, protein, and fiber decreased as the date of first cutting was delayed, the decrease being more consistently pronounced in the case of the protein. This confirms results with other forage species, the nutritive values of which have been estimated at the New Hampshire Agricultural Experiment Station and reported previously (3, 4, 5, 6, 11). The digestibilities determined with sheep show very close agreement with the corresponding values determined with cattle.

Nutritive value

The nutritive value of the hays (Table 2) was determined on the basis of the total digestible nutrients, digestible protein, digestible energy, metabolizable energy, and net energy, all values being determined directly.

The nutritive values of the hays determined by using steers and sheep showed very close agreement. The order of acceptability of the hays by sheep followed the order of the digestibility. The maximum quantity voluntarily consumed by three adult wethers was higher in the early-cut hays.

Summary and Conclusions

The relative nutritive value of redtop hay, grown under a 100 lb. of nitrogen fertilization per acre over a two-year period and harvested at two different stages of maturity and also as aftermath was estimated by means of twenty-six protein and energy digestion and utilization balance experiments. The animals used were two Guernsey steers, two Jersey steers, two Holstein steers, and three adult wethers. The maximum acceptability of the hays was determined by the same three adult wethers used in the digestion balance experiments.

Chemical composition of the hays was affected by delay in the date of first cutting. Fiber content increased and protein content decreased with delayed harvesting. There were slight compositional differences in the hays cut on corresponding dates between years, but these could be attributed to differences in rainfall during the two growing seasons.

Digestibility of nutrients, especially protein, fiber and energy, was adversely affected by delayed date of cutting. The percentage decrease in digestibility per day delay in harvesting the forage ranged from 0.35 to 0.50%. Nutritive value and digestibility changes followed a similar pattern. Delay in harvesting the forage decreased the nutritive value, particularly digestible protein and net energy content. Net energy was more sensitive than TDN as a method of comparing nutritive value. This was indicated by the higher percentage difference between values on the two first cutting dates.

There was very close agreement between the nutritive value of the same hays fed to cattle and sheep. This confirms previous results of cooperative work between this station and the Pennsylvania station (13).

The acceptability of the hays by adult wethers followed the digestibility in that the more digestible hays were more acceptable to the animals.

Redtop is a forage species that can be grown successfully in the Northeast. When grown with a fertilization of 100 lb. of nitrogen per acre, harvested about the middle of June in northern New England and properly cured, a hay is obtained which is palatable and has a nutritive value comparable to that of timothy hay.

Bibliography

1. Benedict, F. G., Coropachinsky, V. and Ritzman, E. G. *Technik der Messung des Gesamtstoffwechsels und des Energiebedarfes von Haustieren.* Abderhalden's Hand. de biolog. Arbeitmethoden, Abt. IV, Teil 13: 619-687. 1934.
2. Brouwer, E., Van Es, A. J. H. and Nijkamp, H. J. *Investigations on Early and Late Cut Hay.* European Assoc. for Anim. Prod. Publ. No. 10, 1961 and Publ. No. 11, 1964.
3. Colovos, N. F., Keener, H. A., Prescott, J. R. and Teeri, A. E. *The Nutritive Value of Timothy Hay at Different Stages of Maturity as Compared With Second Cutting Clover Hay.* J. Dairy Sci., 32: 659. 1949.
4. Colovos, N. F., Keener, H. A., Davis, H. A., Peterson, N. K. and Blood, P. T. *The Effect of Rate of Nitrogen Fertilization and Date of Harvest on Yield, Persistency and Nutritive Value of Bromegrass Hay.* N. H. Agr. Expt. Sta. Bul. No. 472. 1961.
5. Colovos, N. F., Peterson, N. K., Blood, P. T. and Davis, H. A. *The Effect of Rate of Nitrogen Fertilization, Geographic Location, and Date of Harvest on Yield, Acceptability, and Nutritive Value of Timothy Hay.* N. H. Agr. Sta. Bul. 486. 1964.
6. Colovos, N. F., Keener, H. A., Davis, H. A., Reddy, B. S. and Reddy, P. P. *Nutritive Value of the Dairy Cattle Ration as Affected by Different Levels of Urea and Quality of Ingredients.* J. Dairy Sci. 46: 696. 1963.
7. Crampton, E. W. *Interrelationships Between Digestible Nutrient and Energy Content, Voluntary Dry Matter Intake, and the Overall Feeding Value of Forages.* J. Anim. Sci. 16:546. 1962.
8. Flatt, W. P., Coppock, C. E. and Moore, L. A. *Energy Balance Studies With Dry Non-Pregnant Cows Consuming Pelleted Forages.* European Assoc. Anim. Prod. Publ. 11. 1964.
9. Kaishio, Y., Hashizume, T. and Morimoto, H. *Energy Value of Wild Grass Hay and Rice Straw for Maintenance.* European Assoc. for Animal Prod., Publ. No. 10. 1961.
10. Keener, H. A., Colovos, N. F., Morrow, K. S., Foulkrod, G. M., Percival, G. P. and Prescott, J. R. *The Relative Feeding Value of a Forage Preserved by Ensiling, Mow Curing and Field Curing.* N. H. Agr. Expt. Sta. Circ. 77. 1949.
11. Prince, F. S., Blood, P. T. and Percival, G. P. *Studies of Feed Value of Early Hay.* N. H. Agr. Expt. Sta. Circ. 41. 1933.
12. Ritzman, E. G. and Benedict, F. G. *Nutritional Physiology of the Adult Ruminant.* Carnegie Inst. Wash., Publ. 494. 1938.
13. Swift, R. W. and Bratzler, J. W. *A Comparison of Forages by Cattle and Sheep.* Penn. Agr. Expt. Sta. Bul. 651. 1959.